BNL E896: Search for H-dibaryon in RHI collisions

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Experiment 896 (E896) is a search of relativistic Au-Au collisions for the H_o di-baryon, a theoretically predicted short-lived, neutral, six quark particle. The principal apparatus in our experiment are a superconducting magnet (Sweeper), a normal magnet (48D), and a distributed drift chamber (DDC). The Sweeper is employed to sweep charged particles produced in the collisions away from the DDC. The DDC, located in the 48D's 1.6T field, is used to identify the charged particle decay channels, or V's, of unstable neutral particles (e.g. $H_o \to \Sigma + p$) which were emitted from the Au-Au collisions. The 0.6 cm granularity of the DDC, along the beam direction, allows for multiple measurements along short lived tracks and aids in resolving closely neighboring tracks, while the 1m total length of the detector helps us to achieve the momentum resolution required [1].

The collaboration completed its first engineering run of this experiment in February '97. The data from this run (see example below) have been utilized to tune V finding algorithms. At present, the fast finder operates at <2ms/event with a locating efficiency of 40%, thus giving us the ability to quickly reduce the number of uninteresting events in our upcoming April '98 data set by a factor of 10.

Analysis of the February data set has also helped to identify some necessary equipment modifications and upgrades. The sweeper is currently undergoing final acceptance tests on a new suspension system. This new system enables the magnet to run reliably at 6.5T, a 50% improvement over the maximum field achievable during the February run. Similarly the DDC and its electronics have also undergone various enhancements. The length of the DDC has been increased by 20% with the addition of 24 new planes. Upgrades to components on the DDC front end (FEE) cards have made them less susceptible to noise and enabled running at lower thresholds. A new HV distribution system has been designed to provide remote shutdown of individual DDC planes should problems develop. A change in the DDC pulsing scheme has led to identification and replacement of marginal TDC units. The pulsing system has also been used to rigorously test the data readout chain from FEE through on-line displays. Those tests served to optimize the On-line display package and identified some subtle failures in the DAQ system which are currently being corrected.

A subsequent run in June 1997 using a beam of charge=+1 particles tested some of the upgrades mentioned above. The DDC plane efficiency was determined to be ~99%. At that time, the DDC TDC resolution was measured to be between 2.8 to 3.5 ns, corresponding to a momentum resolution of ~1% for particles leaving tracks greater than 20cm. Further, it was determined that the parameterization of the TDC tracking code[2] did require slight modification from what had been calculated using the CERN packages GEANT and GARFIELD

The collaboration is continuing to prepare for another 11.3 GeV/c Au run in April. From the analysis of data taken last February and June, we have determined that: 1) the track density in the DDC is indeed sparse enough to allow recognition and reconstruction of neutral particle decays; 2) the distortion of the drift lines is consistent with the GEANT/GARFIELD simulations but does require actual data to optimize for a best fit; and 3) the track reconstruction and momentum resolution are within the tolerances set by the GEANT simulations to unambiguously identify a decaying H_o.

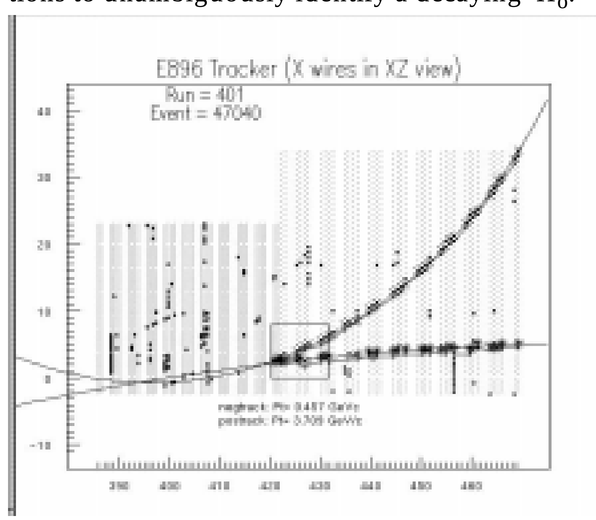

Figure: Display of DDC wire and TDC information recorded for a typical Au-Au central collision

Footnotes and References

1 I.Sakrejda, LBL-37384 UC-413, 125 (1995).
2 J.Engelage, LBL-39764 UC-413, 125 (1996).